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Quality Control of Concrete Mixtures at the Plant – Double A

July 27, 2001

This special provision was developed by the Bureau of Materials and Physical Research. It specifies the quality control responsibilities (requirements for aggregate gradations, aggregate moisture, slump, air content, unit weight/yield, and temperature) of the Contractor at the plant, and defines the quality assurance and acceptance responsibilities of the Engineer. It has been revised to reflect changes in the Aggregate Gradation Control System Program.

This special provision should be inserted, as directed by the District, on projects where the Department would not perform plant quality control. The Department would perform jobsite quality control/acceptance testing only, according to the Project Procedure Guide.

The districts should include the BDE Check Sheet marked with the applicable special provisions for the November 9, 2001 and subsequent lettings. The Project Development and Implementation Section will include the paper copy in the contract.

This special provision will be transferred through the E-mail System to the district offices on July 27, 2001.

80019m

QUALITY CONTROL OF CONCRETE MIXTURES AT THE PLANT - DOUBLE A (BDE)

Effective: August 1, 2000
Revised: November 1, 2001

Description. This Special Provision specifies the quality control responsibilities of the Contractor at the plant, for portland cement concrete mixtures, cement aggregate mixture II, and controlled low-strength material incorporated in the project, and defines the quality assurance and acceptance responsibilities of the Engineer.

The Contractor, by application for and receipt of prequalification, by submission of a bid and, if awarded the contract, by execution of the contract containing this Special Provision, certifies that it fully and thoroughly understands all aspects and requirements of this Special Provision; that it possesses the latest edition of and thoroughly understands all aspects and requirements of the procedures, manuals and documents referred to and incorporated by reference in this Special Provision; and that it waives and releases any and all claims of misunderstanding or lack of knowledge of the same. Furthermore, the Contractor understands and agrees that compliance with the requirements of this Special Provision and the Quality Control Plan approved by the Engineer is an essential element of the contract. Failure to comply with these requirements can result in one or more of the following: a major breach of this contract and default thereof, a loss of prequalification and a suspension of the Contractor from bidding.

A list of quality control/quality assurance (QC/QA) documents is provided in Schedule C.

Materials. For concrete, aggregates (except finely divided minerals) shall be produced according to the Department's Policy Memorandum “Aggregate Gradation Control System”. Gradations other than those in the Standard Specifications may be used if produced according to the Department's “Aggregate Gradation Control System”.

For controlled low-strength material, the Department’s “Aggregate Gradation Control System” will not apply.

Equipment/Laboratory. The Contractor shall provide a laboratory and test equipment to perform their quality control testing, as required in Schedule A.

The laboratory shall be of sufficient size and be furnished with the necessary equipment, supplies, and current published test methods for adequately and safely performing all required tests. The laboratory will be approved by the Engineer at the beginning of each construction season or each 12 month period. Production of a mixture shall not begin until the Engineer provides written approval of the laboratory. The Contractor shall refer to the Department's "Required Sampling and Testing Equipment for Concrete" for equipment requirements.

Test equipment shall be maintained and calibrated as required by the appropriate test method, and when required by the Engineer. This information shall be documented on the Department's "Calibration of Concrete Testing Equipment" form.

The Engineer shall have unrestricted access to the plant and laboratory at any time to inspect measuring and testing equipment, and will notify the Contractor of any deficiencies. Defective equipment shall be immediately repaired or replaced by the Contractor.

Plant/Delivery Trucks. The concrete plant and delivery trucks shall be approved according to the Department's Policy Memorandum "Approval of Concrete Plants and Delivery Trucks."

Quality Control Plan. The Contractor shall submit, in writing, a proposed Quality Control (QC) Plan, Part 2, to the Engineer. The QC Plan shall be submitted a minimum of 45 calendar days prior to the production of a mixture. The QC Plan shall address the quality control of the concrete, cement aggregate mixture II, and controlled low-strength material at the plant. The Contractor shall refer to the Department's "Model Quality Control Plan for Concrete Production" to prepare a QC Plan. The Engineer will respond in writing to the Contractor's proposed QC Plan within 15 calendar days of receipt.

Production of a mixture shall not begin until the Engineer provides written approval of the QC Plan. The approved QC Plan shall become a part of the contract between the Department and the Contractor, but shall not be construed as acceptance of any mixture produced.

The QC Plan may be amended during the progress of the work, by either party, subject to mutual agreement. The Engineer will respond in writing to a Contractor's proposed QC Plan amendment within 15 calendar days of receipt. The response will indicate the approval or denial of the Contractor's proposed QC Plan amendment.

Plant Quality Control by Contractor. At the plant, the Contractor shall perform quality control inspection, sampling, testing, and documentation to meet contract requirements. Quality control includes the recognition of obvious defects and their immediate correction. Quality control also includes appropriate action when passing test results are near specification limits. Quality control may require increased testing, communication of test results to the plant or the jobsite, modification of operations, suspension of mixture production, rejection of material, or other actions as appropriate. The Engineer shall be immediately notified of any failing tests and subsequent remedial action. Passing tests shall be reported no later than the start of the next work day.

When a mixture does not comply with specifications, the Contractor shall reject the material; unless the Engineer accepts the material for incorporation in the work, according to Article 105.03.

(a) Personnel Requirements. The Contractor shall provide sufficient personnel to perform the required inspections, sampling, testing, and documentation in a timely manner. A Quality Control (QC) Manager will not be required. The Contractor shall refer to the Department's "Qualifications and Duties of Concrete Quality Control Personnel" document.

A Level II PCC Technician shall be provided at the plant, or shall be available, during mixture production and placement. A Level II PCC Technician may supervise a

maximum of three plants. Whenever the Level II PCC Technician is not at the plant during mixture production and placement, a Concrete Tester or Level I PCC Technician shall be present at the plant to perform any necessary concrete tests. The Concrete Tester, Level I PCC Technician, or other individual shall also be trained to perform any necessary aggregate moisture tests, if the Level II PCC Technician is not at the plant during mixture production and placement. The Concrete Tester, Level I PCC Technician, plant personnel, and jobsite personnel shall have the ability to contact the Level II PCC Technician by cellular phone, two-way radio, or other methods approved by the Engineer.

A Concrete Tester may provide assistance with sampling and testing, and shall be supervised by a Level I or Level II PCC Technician.

(b) Required Plant Tests. Sampling and testing shall be performed at the plant, or at a location approved by the Engineer, to control the production of a mixture. The required minimum Contractor plant sampling and testing is indicated in Schedule A.

Plant Quality Assurance by Engineer. The Engineer will perform quality assurance tests on independent samples and split samples at the plant. An independent sample is a field sample obtained and tested by only one party. A split sample is one of two equal portions of a field sample, where two parties each receive one portion for testing. The Engineer may request the Contractor to obtain a split sample. Aggregate split samples shall be retained until permission is given by the Engineer for disposal. The results of all quality assurance tests by the Engineer will be made available to the Contractor as soon as they are completed. The Engineer's quality assurance independent sample and split sample testing is indicated in Schedule B.

(a) Comparing Test Results. Differences between the Engineer's and the Contractor's split sample test results will not be considered extreme if within the following limits:

Test Parameter	Acceptable Limits of Precision
Slump	20 mm (0.75 in.)
Air Content	0.9 percent
Aggregate Gradation	See "Guideline for Sample Comparison" in Appendix "A" of the Manual of Test Procedures for Materials.

(b) Test Results. If either the Engineer’s or the Contractor’s split sample test result is not within specification limits, and the other party is within specifications limits; immediate retests on a split sample shall be performed for slump, air content, or aggregate gradation. A passing retest result by each party will require no further action. If either the Engineer’s or Contractor’s slump, air content, or aggregate gradation split sample

retest result is a failure, and the other party is within specification limits; the following actions shall be initiated:

(1) The Engineer and the Contractor shall investigate the sampling method, test procedure, equipment condition, equipment calibration, and other factors.

(2) The Engineer or the Contractor shall replace test equipment, as determined by the Engineer.

(3) The Engineer and the Contractor shall perform additional testing on split samples, as determined by the Engineer.

(4) For aggregate gradation, if the failing test result is not resolved according to (1), (2), or (3), and the mixture has not been placed, the Contractor shall reject the material; unless the Engineer accepts the material for incorporation in the work, according to Article 105.03.

For aggregate gradation, if the result of a quality assurance test on a sample independently obtained by the Engineer is not within specification limits, and the mixture has not been placed, the Contractor shall reject the material, unless the Engineer accepts the material for incorporation in the work, according to Article 105.03.

If a continued trend of difference exists between the Engineer's and the Contractor's split sample test results, or if split sample test results exceed the acceptable limits of precision, the Engineer and the Contractor shall investigate. The investigation shall be according to (1), (2) and (3).

Jobsite Acceptance Testing by the Engineer. The Engineer will perform acceptance testing at the jobsite for slump, air content, and strength.

Acceptance by the Engineer. Final acceptance will be based on the Standard Specifications and the following:

(a) The Contractor's compliance with all contract documents for quality control.

(b) Comparison of the Engineer's jobsite acceptance test results with specification limits, using samples independently obtained by the Engineer.

(c) Validation of Contractor plant quality control test results by comparison with the Engineer's quality assurance test results using split samples.

(d) Comparison of the Engineer's plant quality assurance test results with specification limits using samples independently obtained by the Engineer.

The Engineer may suspend mixture production, reject materials, or take other appropriate action if the Contractor does not control the quality of concrete, cement aggregate mixture II, or

controlled low-strength material for acceptance. The decision will be determined according to (a), (b), (c), and (d).

Documentation. The Contractor shall be responsible for documenting all observations, inspections, adjustments to the mix design, test results, retest results, and corrective actions in a bound hardback field book, bound hardback diary, or appropriate Department form, which shall become the property of the Department. The documentation shall include a method to compare the Engineer's test results with the Contractor's results. The Contractor shall be responsible for the maintenance of all permanent records whether obtained by the Contractor, the consultants, subcontractors, or the producer of the mixture. The Contractor shall provide the Engineer full access to all documentation throughout the progress of the work.

The Department's form MI 504M shall be completed by the Contractor, and shall be submitted to the Engineer weekly or as required by the Engineer. A correctly completed Form MI 504M is required to authorize payment by the Engineer, for applicable pay items.

The Engineer will be responsible for completing form MI 654 and form MI 655.

Basis of Payment. Quality Control of Concrete Mixtures at the Plant will not be paid for separately, but shall be considered as included in the cost of the various types of concrete mixtures required to construct the work items included in the contract.

SCHEDULE A
CONTRACTOR PLANT SAMPLING AND TESTING — DOUBLE A

ITEM	TEST	FREQUENCY	IL MODIFIED AASHTO, IL MODIFIED ASTM, OR DEPARTMENT TEST METHOD (a)
Aggregates (Arriving at Plant)	Gradation (b)	As needed to check source for each gradation number	T 2, T 11, T 27 and T 248
Aggregates (Stored at Plant in Stockpiles or Bins)	Gradation (b)	1,900 cu m (c) (2,500 cu yd) for each gradation number	T 2, T 11, T 27 and T 248
Aggregates (Stored at Plant in Stockpiles or Bins)	Moisture (d) Fine Aggregate	Once per week for moisture sensor, otherwise daily for each gradation number	Flask, Dunagan, Pychnometer Jar, or T 255
	Moisture (d) Coarse Aggregate	As needed to control production for each gradation number	Dunagan, Pychnometer Jar, or T 255
Mixture (e)	Slump Air Content Unit Weight/ Yield Temperature	As needed to control production	T 141 and T 119 T 141, and T 152 or T 196 T 141 and T 121 T 141 and ASTM C 1064

Notes: (a) Refer to the Department's "Manual of Test Procedures for Materials".

(b) The first test and every third test thereafter shall be washed. Testing shall be completed no later than 24 hours after the aggregate has been sampled.

(c) One per week (Sunday through Saturday) minimum. One per day minimum if pouring bridge deck.

(d) If the moisture test and moisture sensor disagree by more than 0.5 percent, retest. If the difference remains, adjust the moisture sensor to an average of two or more moisture tests, using the Dunagan or Illinois Modified AASHTO T 255 test method.

The Department's "Water/Cement Ratio Worksheet" form shall be completed when applicable.

(e) The Contractor may also perform strength testing according to Illinois Modified AASHTO T 141, T 23, and T 22 or T 177; or water content testing according to Illinois Modified AASHTO TP23; or other tests at the plant to control mixture production.

SCHEDULE B

ENGINEER QUALITY ASSURANCE INDEPENDENT SAMPLE TESTING

LOCATION	MEASURED PROPERTY	TESTING FREQUENCY (a)
Plant	Gradation for Aggregates Stored in Stockpiles or Bins, Slump and Air Content	As determined by the Engineer.

ENGINEER QUALITY ASSURANCE SPLIT SAMPLE TESTING

LOCATION	MEASURED PROPERTY	TESTING FREQUENCY (a)
Plant	Gradation for Aggregates Stored in Stockpiles or Bins (b)	At the beginning of the project, the first test performed by the Contractor. Thereafter, a minimum of 10 % of total tests required of Contractor will be performed per aggregate gradation number and per plant.
	Slump and Air Content	As determined by the Engineer.

(a) The Engineer will perform the testing throughout the period of quality control testing by the Contractor.

(b) The Engineer will witness, a minimum of one a month, the split sample obtained by the Contractor.

SCHEDULE C

ILLINOIS DEPARTMENT OF TRANSPORTATION

CONCRETE QUALITY CONTROL DOCUMENTS

1. Model Quality Control Plan for Concrete Production (*)
2. Qualifications and Duties of Concrete Quality Control Personnel (*)
3. Development of Gradation Bands on Incoming Aggregate at Mix Plants (*)
4. Required Sampling and Testing Equipment for Concrete (*)
5. Calibration of Concrete Testing Equipment (*)
6. Water/Cement Ratio Worksheet (*)
7. Field/Lab Gradations (Form MI 504M)
8. Manual of Instructions for Design of Concrete Mixtures
9. Aggregate Technician Course Workbook
10. Portland Cement Concrete Tester Course Manual
11. Portland Cement Concrete Level I Technician Course Manual
12. Portland Cement Concrete Level II Technician Course Manual
13. Manual of Test Procedures for Materials

* Refer to the Manual of Test Procedures for Materials

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